

IMOS Evaluation of NGST

Initial Calibration of IMOS for use as
the Systems Engineering
Evaluation Tool in the
Development of the NGST

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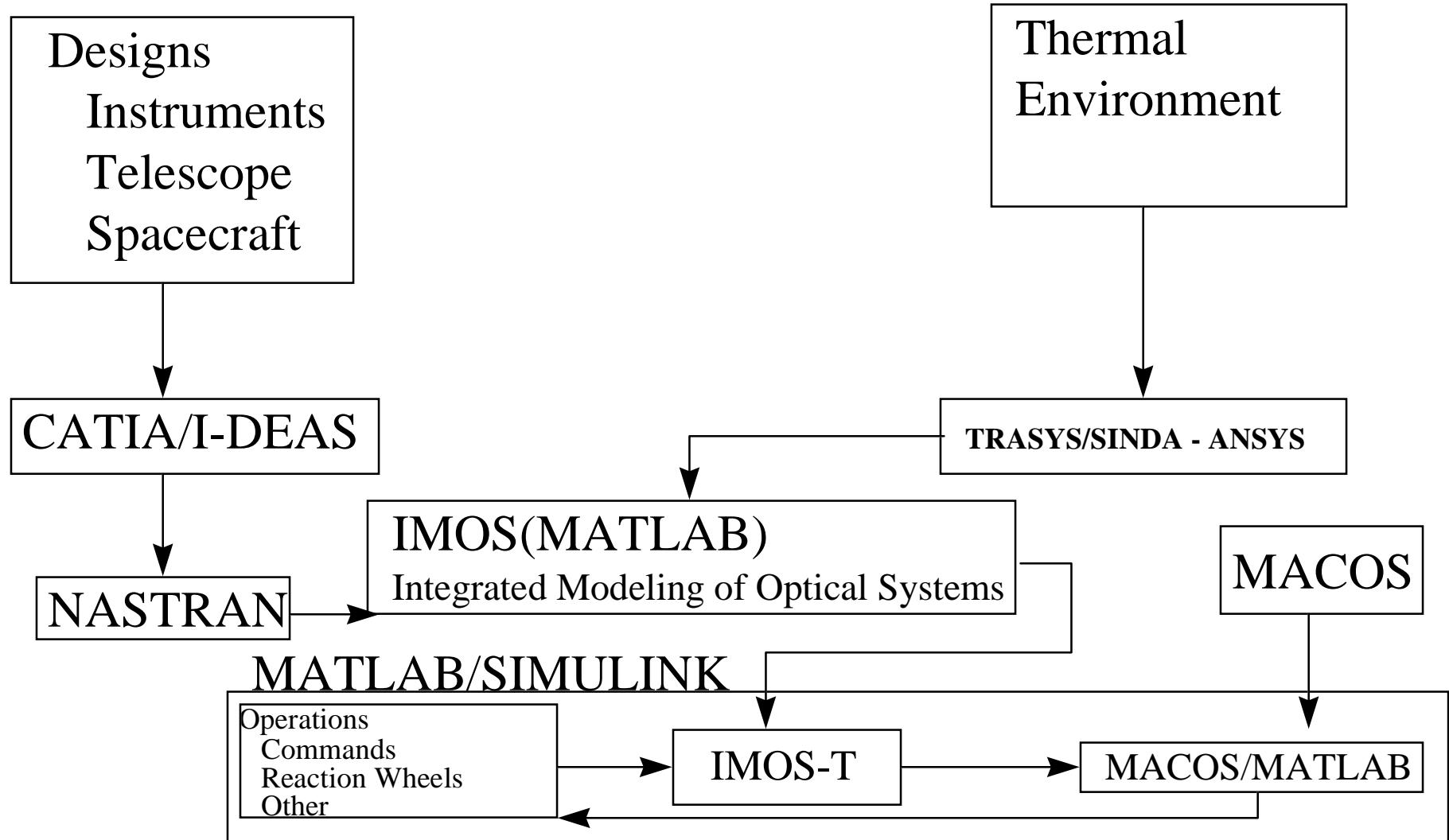
GSFC Next Generation Space Telescope



Systems Engineering Evaluation Criteria and Procedure

- Optical Performance Measured as a Function of Thermal Distortion and Vibration
- CATIA, I-DEAS and/or ProEngineer Designs will be created
 - Spacecraft Options
 - OTA Designs
- IMOS model generated and evaluated

IMOS Evaluation Procedure



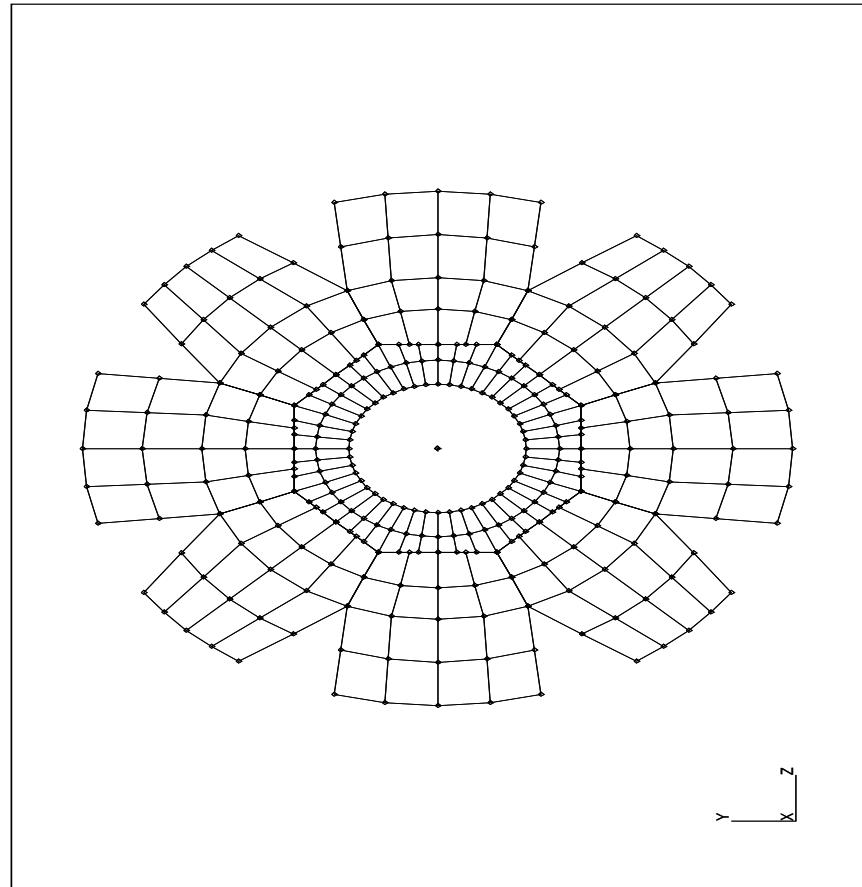
Calibration Of IMOS Using GSFC Telescope Model

- Use Existing GSFC 346 Node PM Model
 - Fully Debugged and Verified
 - Will Yield baseline Results for Comparision of TRW and Other Defined Surfaces
- Thermal Distortion of OTA over an expected Temperature Gradient
- Compare MACOS Generated OPD of Non-Distorted and Distorted Mirrors

FEM PM Model

Assume:

- Nodes Correspond to Actuator Locations
- PM Optic Surface Supported by Actuators
- Actuator Backing Structural Deformations Similar to PM Deformations



Linear Conduction Problem

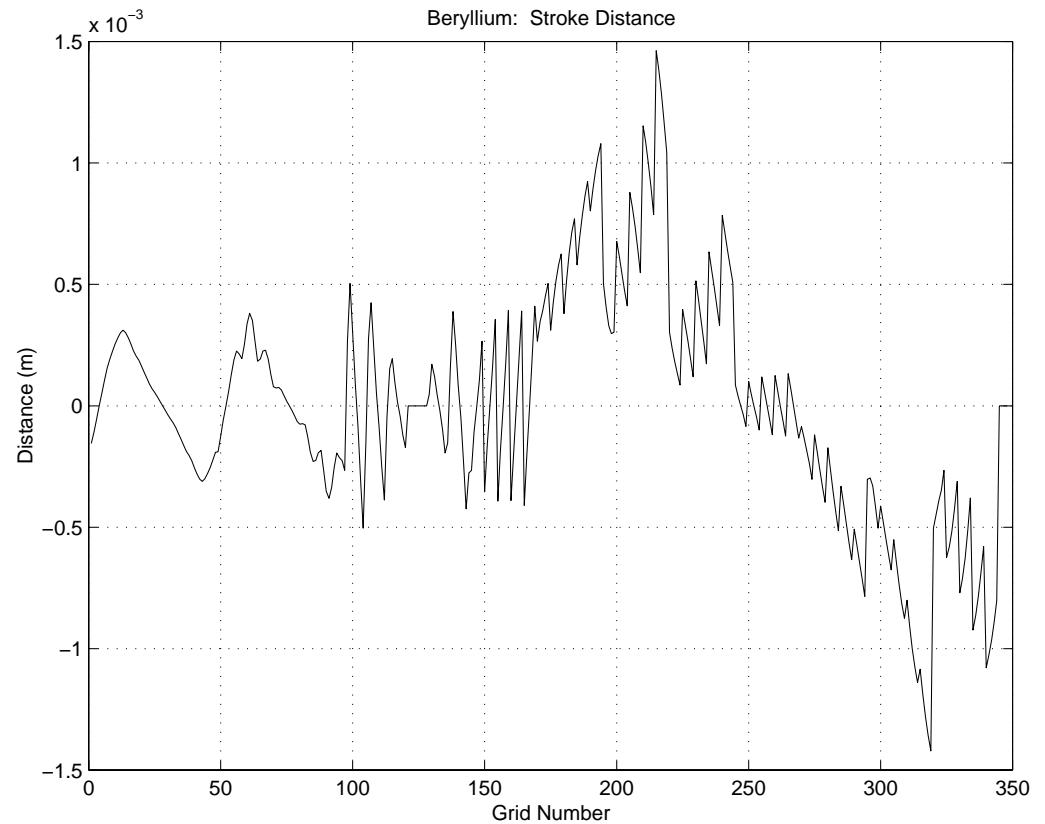
- NASTRAN Used to Generate Temperatures and Resulting Displacements
- 10 - 30 deg. K Gradient Applied Across Face
- Constant Properties vs. Temperature
- RMS OPD Error Computed in MACOS
- Max Actuator Stroke Determined in Matlab

Thermal Distortion Study

- 41 m² Surface Area PM
- 4 Materials with Identical Mass (10 Kg/m² reqt.):
 - Beryllium: 5.4 mm thick
 - SiC: 3.1 mm thick
 - Fused Silica: 4.5 mm thick
 - Zerodur: 3.9 mm thick

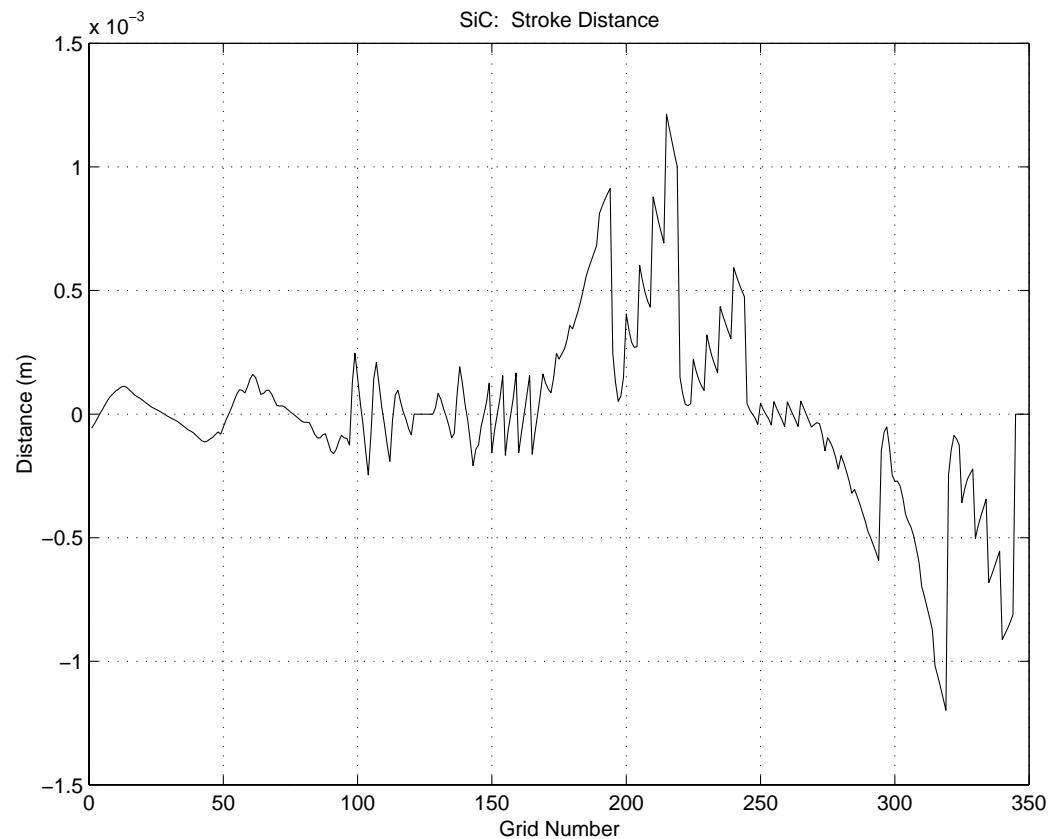
Computational Example: Beryllium

- 6.979E-2 RMS OPD Error
- 1.4626 mm Max Stroke
- Undistorted RMS OPD Error:
2.053E-8



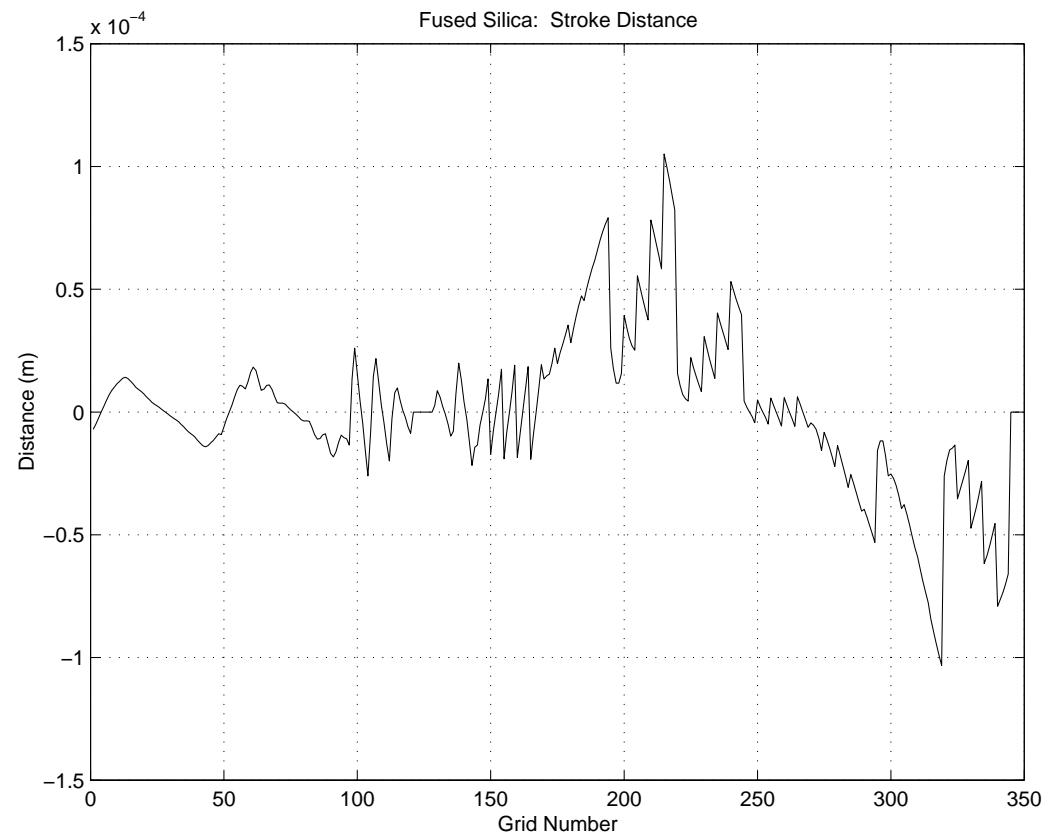
Computational Example : SiC

- 6.171E-2 RMS OPD Error
- 1.2140 mm Max Stroke



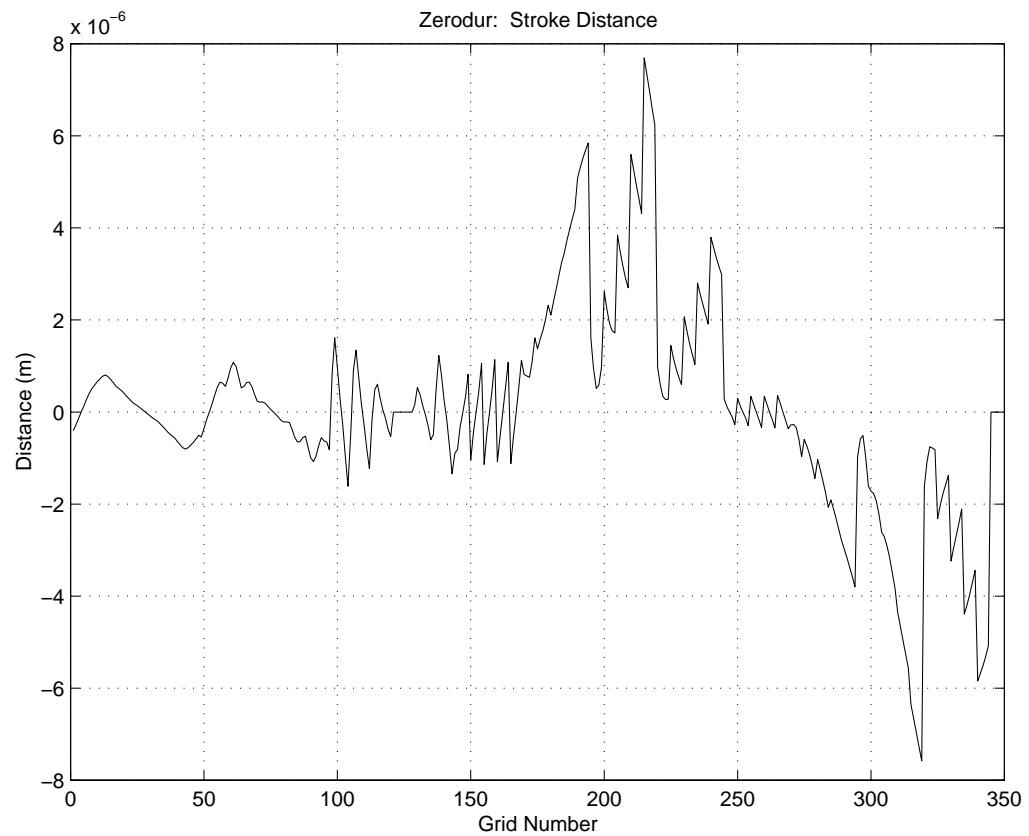
Computational Example: Fused Silica

- 1.946E-2 RMS OPD Error
- 0.1051 mm Max Stroke



Computational Example: Zerodur

- 6.420E-3 RMS OPD Error
- 7.6919 microns Max Stroke



Conclusions

- Interpolated Surface Algorithms Validated for NGST PM Analysis as part of TRW Systems Engineering Study
- Adaptive Optics Concept for PM Required to Remove Thermal Distortions

NGST Mission Concept

- NGST
 - 8 Meter Deployable Cassegrain Telescope with cameras and spectrometers covering the 0.5 to 10 um spectral region
 - 6000 lb maximum weight - S/C and Optical Telescope Assembly
 - Sunshade, extendible boom and thermal shield permit passive cooling of telescope and instruments